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Disposal of obsolete pesticides including DDT in a Chinese cement plant as blueprint for future environmentally sound co-processing of hazardous waste including POPS in the cement industry

Yeqing Li[a,*], Huanzhong Wang[b], Jiang Zhang[c], Jiajun Wang[d]

[a,d] *Huaxin Cement Ltd, Tower 5, Int'L Enterprise Center,No. T1 Guanggu Avenue 430073 Wuhan, P.R. China, 430075*
[b,c] *Huaxin Environment Engineering Co. Ltd,, Tower 5, Int'L Enterprise Center,No. T1 Guanggu Avenue 430073 Wuhan, P.R. China, 430073*

Abstract

In September 2009, 350 tons of Obsolete Pesticides (OP) including 160 tons of DDT (dichlorodiphenyltrichloroethane, a Persistent Organic Pollutant, POP) has been successfully disposed as a business case in Huaxin Jinmao Cement Company at Suzhou, China. Disposal of the Ops was carried out in a New Suspension Pre-calciner (NSP) kiln with clinker capacity of 3'200 tons per day. Before disposal campaign, a comprehensive trial burn scheme designed beforehand was conducted to find out the optimized operation parameters such as feeding rates and to get insight of Destruction Removal Efficiency (DRE) of DDT and as well as the emission level of Dioxins/Furans. In the trial, DDT feeding rates ranged from 150kg/h, 500kg/h, 1'000 kg/h and up to 2'000 kg/h at maximum. The results revealed that DRE of 99.99999% and emission of Dioxins/Furans well below 0.1 ng TEQ/Nm3 were found out when 2 tons of DDT preparations of 30% chlorine content in the highest among the series are fed to the kiln.

Keywords: DDT; Cement kiln; Co-processing; DRE; PCDD/F

∗ Corresponding author. Tel.: +86-27-87806060-689618.
E-mail address: liyeqing@huaxincem.com

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1. Introduction

Two main objectives of Sino-Germany Obsolete Pesticide Management Project were 1) to conduct the inventory mapping of obsolete pesticides in three pilot provinces, Jiangsu, Hubei and Jilin and 2) consequently to introduce BAT to dispose the wastes discovered in an environmental sound manner. In Jiangsu a total of 350 tons of OP was discovered, including 160 tons of DDT. DDT is regarded as one of the substances to be most difficultly decomposed in nature. Based on technical assessment from the expertise and panel of the project and also global experience [1], Huaxin Jinmao Cement Company was selected to fulfill the task for disposal of the ops. Jinmao company owned a new suspension pre-heater and pre-calciner cement kiln with clinker production capacity 3,200t/d. For ensuring a better DRE for DDT and Dioxin/furans emission, a comprehensive trial burn scheme was prepared and executed under supervision of Chinese Research Academy of Environmental Sciences.

A trial burn planned is consisting of a series of tests for base line (blank) and trial burn. In this trial, DDT was fed into pre-calciner where the atmosphere temperature is about 1000C and DDT feeding rate was adjusted from 0 kg/h as base line to 150kg/h, 500kg/h, 1000kg/h and 2000kg/h at maximum. The trial burn was carried out on September 11, 12,13,14,15 of 2009 respectively.

To understand how DDT is destructed at the kiln i.e. to get an idea about DRE, a sampling plan was scheduled and shown in Table.1

Table.1 DDT sampling

Parameters	Sampling/measure points	Notes
Input DDT concentration	DDT feeding point	1 sample/h, 8 samples/d, 1mixed sample
Exhaust gas DDT conc.	Main stack	1 sample/2h, 2,1 3,3,3 samples for 11, 12,13,14,15 of Sep
Exhaust gas volume	Main stack	Online
Bag filter dust DDT conc.	Bag filter dust convery	4
Bag filter dust volume	Bag filter dust convery	Online
Raw meal feeding rate	Raw meal elevator	Online
Clinker production	Clinker convery	Online

To evaluate the environmental impact on the cement kiln exhaust gas and to be abided by the national regulation, the exhausting gas had been sampled and the following items analyzed: PCDD/F, Dust, CO, CO2, SO2, NOX, Benzene, DDT, Cl, HCl, HF, NH3 and TVOC.

2. Materials and Methods

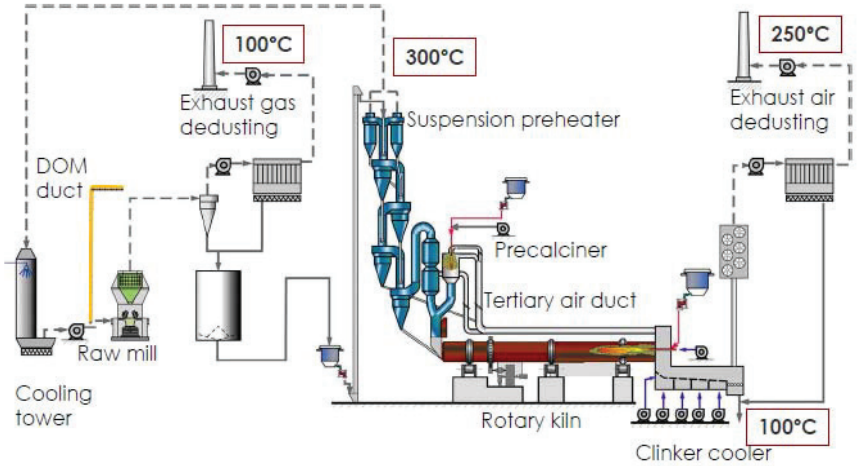

Figure.1 Clinker production process

3. Results and Discussion

For having a DRE, the results can be calculated according to the formula [2] shown as below

$$DRE=[(Win-Wout)/Win]\times 100\%$$

$$Win = MI\times CDDT,I$$

$$Wout=VG\times CDDT,G$$

Win: DDT input

Wout: DDT output

MI: DDT input volume to cement kiln, t/h,

CDDT,I: DDT concentration in DDT input,

VG: Exhausting gas from cement kiln system, m3/h,

CDDT,G: DDT concentration in exhausting gas,

All the data for DDT DRE calculation and results are shown in Table.2.

Table.2 DDT DRE parameters

Sample number	DDT feeding rate (kg/h)	DDT conc. (%)	Gas DDT conc. (mg/m3)	Gas volume (m3/h)	Bag filter dust DDT(mg/kg)	DDT DRE (%)
091101	-	-	UD	3.19×105	UD	-
091102			UD	3.67×105		-
091201	150	23.6	UD	3.26×105	UD	99.999998
091301	500	23.8	UD	3.54×105	UD	99.9999994
091302			UD	3.43×105		99.9999995
091303			UD	3.36×105		99.9999995
091401	1000	22.2.	4.9×10-5	3.28×105	0.009	99.9999996
091402			5.1×10-5	3.33×105		99.9999996
091403			5.4×10-5	3.36×105		99.9999996

091501	2000	31.1	7.3×10-5	3.38×105	0.014	99.9999996
091502			6.9×10-5	3.3×105		99.9999996
091503			6.3×10-5	3.25×105		99.9999996

- UD: Under Detection Limit
- Detection Limit for DDT: 0.03μg/M3

Table.3 PCDD/F from exhaust gas

Sample number	091101	091102	091201	091301	091401	091402	091501	091502	091503
PCDD/F (ng I -TEQ /Nm3)	0.012	0.0051	0.0057	0.016	0.0078	0.016	0.0034	0.013	0.087

DDT was not detected in the clinker.

4. Conclusion

From this trial burn, the following conclusions can be summarized:

DDT can be highly decomposed with high feeding rate (up to 2000kg/h) in NSP cement kiln.

All stack gas emissions can meet the national standards and some even far below the limits

DDT wasn't founded in the product (clinker)

DDT can be detected in bag filter dust, but only if the feeding rate is as high as 2000kg/h

The bag filter dust is fed to the kiln again; hence, there is no negative environmental impact from this disposal.

With the help of this successful business case, Chinese environmental authorities might introduce officially co-processing of pops in the cement industry as BAT to fulfill her commitments to Stockholm Convention on pops issue in China.

Acknowledgement

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